REMARKS

The Office Action indicated that the subject matter of Claim 29 would be allowed in independent form. Accordingly, independent Claim 28 has been amended to incorporate the allowed subject matter of Claim 29, and it is believed that the dependent claims from Claim 29, including Claim 2 and Claim 30, are also allowable.

Applicant is now presenting Claims 31-75 consistent with the previously examined claims. The Office Action had rejected previous Claim 27 as being completely anticipated by the *Inoue et al.* (U.S. Patent No. 6,236,159). The subject matter of Claim 27 is now presented as independent Claim 54.

Claims 1-13 and 15-17 were held to be obvious over a combination of the *Kanagu* (U.S. Patent No. 5,846,110) in view of the *Cho* (U.S. Patent No. 6,109,994). Additionally, Claims 18-26 were rejected as being obvious over the *Kanagu et al* reference in view of *Cho et al.* when taken in view of the *Aoki et al.* (U.S. Patent No. 5,951,350).

As the Examiner is aware, a purpose of the present invention is to provide a PDP that exhibits high light emitting efficiency and superior color reproduction. Referring to new Claim 31, a method of manufacturing a PDP includes a phosphor layer forming process, a sealant layer forming process for forming <u>a sealant layer having a softening point of 410°C or higher</u>, and a sealing process for sealing by heating the sealant layer in a dry gas atmosphere. In the sealant layer forming process, the sealant layer is formed with either plural protrusions or plural depressions in at least one part of the sealant layer at certain intervals formed on at least one of the peripheral regions of the panels, and a shape of the sealant layer is set so as to provide at least one gap between the peripheral regions of the front panel and the back panel when the front panel and the back panel are placed facing each other. The at least one gap allows gas to pass

between the inner space between the panels that is surrounded by the sealant layer and an outside of the panels through the side gaps.

Gaps through which a gas can circulate are maintained in the periphery of the PDP until the sealant layer is heated to a temperature of its softening point. Therefore, the moisture that has been evaporated into the inner space can escape, instead of being trapped within the inner space. This prevents the phosphors from being exposed to an atmosphere containing a large amount of moisture. Therefore, heat deterioration in the phosphors (especially in the blue phosphors $BaMgAl_{10}O_{17}$: Eu) during the sealing process can be prevented. Also, because the sealing process is carried out in a dry gas atmosphere, heat deterioration of the phosphors can be more effectively prevented.

The present invention has found that the heat deterioration in the phosphors for use in a PDP (particularly in the blue phosphors) is likely to occur when the phosphors are heated in an atmosphere that contains a large amount of moisture, and that a "large amount of steam is emitted when the MgO layer is heated at a temperature range of 200 to 250°C in a sealing process included in a PDP manufacturing method."

Independent Claim 31 sets the softening point of the sealant layer at 410°C or higher. As described in the fourth embodiment in our specification gaps, provided in the periphery, can be maintained until the panels are heated to a higher temperature, allowing more moisture to be released from the inner space to the outside. A larger amount of moisture is released from the inner space to the outside while the panels are being heated, thereby reducing an amount of moisture trapped in the inner space. Accordingly, deterioration of the phosphors can be effectively prevented. In support of this, the embodiment in the specification includes the statement, "In comparing the light-emitting characteristics of the panel 3 for which a sealant

layer having a softening point of 385°C was used and the panel 9 for which a sealant layer having a softening point of 415°C was used, the panel 9 is superior to the panel 3".

As further described in the fifth embodiment, sealing glass having a softening point of 380°C to 390°C is typically used for the sealant layer. None of the references *Inoue et al.*, *Kangu et al.*, and *Cho et al.* suggest the use of sealing glass with a higher softening point for a sealant layer. Accordingly, Claim 31 would not be obvious over these references.

Further, according to Claims 34, 35 and 38, a glass sealant layer is formed to have a uniform width after the sealing, as described in the third embodiment of the specification. This feature can prevent a glass sealant layer from flowing into the display area and from deteriorating the display quality. This characteristic and effect is not suggested by any of the references *Inoue et al.*, *Kangu et al.*, and *Cho et al.*

According to Claim 55, a difference between the highest temperature in the sealing process and the softening point of the sealant layer is 40°C or less. As described in our fifth embodiment, this design feature can reduce the amount of moisture emitted into the inner space after the gaps between the panels have been eliminated, even when a sealing glass with a softening point equivalent to a conventional one is used. Therefore, heat deterioration of the phosphors can be more effectively prevented. This characteristic and effect is not suggested by the references *Inoue et al.*, *Kangu et al.*, and *Cho et al.*

A PDP defined in Claims 46 to 52 and an image display apparatus defined in Claim 53 includes a PDP manufactured using the manufacturing method of Claim 31. This PDP is characterized by including blue phosphor layers with reduced deterioration. Due to this, favorable light-emitting characteristics can be obtained as described in the specification.

To produce a PDP with such favorable light-emitting characteristics, an inventive method is required, such that "the sealing process is carried out in such an atmosphere that allows the phosphor layers to come in contact with a dry gas". When a PDP is manufactured using a conventional typical PDP manufacturing method, the phosphor layers are deteriorated by steam. Therefore, a PDP with favorable light-emitting characteristics as enabled by Claims 46 to 53 cannot be manufactured using conventional methods. Furthermore, if a PDP is manufactured using the methods described in the references *Kangu et al.*, *Cho et al.*, and *Aoki et al.*, the blue phosphor layers are likely to be deteriorated by steam in the sealing process.

Further with regard to Claim 31, the method step includes forming a sealant layer about a peripheral region of the front panel and the back panel, and having at the side wall a gap between the peripheral regions so that gas can pass strictly between the inner space between the front and back panel and extend outside of the panel through the sealant layer.

The *Inoue et al.* reference does not disclose an equivalent peripheral sealing layer with gaps, but rather discloses element 32, a solid sealing member, with vent holes 31a - 31d extending directly through the face of a substrate or panel. As noted in Column 15, cleaning gas can be introduced and repeatedly started and stopped at particular temperatures before a predetermined impurity gas release temperature is reached. Presumably, the predetermined impurity gas release temperature for H_2O would be above 100°C. The impurity gases that may exist in the inter-rib spaces between the panels are forcibly expelled through the vent hole in the panels, not through gaps or a gap in the peripheral sealing material. In fact, the *Inoue et al.* reference even contemplates using a getter to absorb the impurity gases.

The *Inoue et al.* reference further contemplates that the panel may be evacuated under electric discharge while gas is being forcibly introduced through the vent holes in order to insure

a smooth flow of the gas through the gas flow barriers. Thus, the prime teaching of the *Inoue et al.* reference is the location and positioning of a series of central rib barriers while introducing and removing gases directly through the substrates or panels.

As noted in Claim 31, our application of a dry gas at a temperature above the softening point of 410°C also takes advantage of the fact that the sealing layer is formed with plural protrusions or depressions in the peripheral regions of the panels so that gas can pass through the sealant layer to a position outside of the panels. The *Inoue et al.* reference does not teach nor suggest this feature.

Referring to Claim 54, a specific gas circulating unit for directing heating gas to the sides of the panels so as to be able to directly circulate the heating gas from the outer regions of the panels to an inner space is required. The *Inoue et al.* reference utilizes tubes connected to the vent holes directly through the faces of the panels and is not directing heating gas to the sides.

A PDP sealing apparatus defined in Claim 54 is characterized by including a gas circulating unit for directing heating gas towards the sides of the panels so as to circulate the heating gas from the outer regions of the panels through an inner space between the panels. Using the manufacturing method of Claim 31 or 35, as described in the second embodiment, the dry gas is directed into an inner space between the panels through the gaps formed in the side periphery, and therefore, moisture is efficiently released from the inner space to outside of the panel. As a result, heat deterioration of the blue phosphors can be more effectively prevented.

The reference *Inoue et al.* fails to suggest this characteristic and effect of such an open gas circulating unit. Therefore, Claim 54 is not obvious over this reference.

The *Kanagu et al* reference specifically sought to address a warping problem that occurs in large size plasma panels. This problem is addressed by a pair of intentionally bent convex

surfaces for both the front and back panels. Additionally, the peripheral sealing layer 31a must be heated at a temperature below the warping temperature in order to retain the desired stress level. There is certainly no specific description about the shape or configuration of the sealing layer 31, nor is there any teaching of leaving a plurality of space gaps so that removal of contaminating gases can occur by circulating dry air while closing and sealing the panel. *Kanagu et al* expressly teaches using a vacuum pump to remove any impurity gases after the sealing process has been accomplished, as set forth in Column 8, Lines 10-20.

The Office Action recognized that *Kanagu et al* was deficient in disclosing the shape of the sealing layer and, accordingly, relied on the *Cho et al.* reference. The *Cho et al.* reference, however, as previously mentioned, would teach away from the features desired in the *Kanagu et al.* reference since it was seeking to provide a localized energy application to create a "gap-jumping technique" where a seal would be created only in a specific area. Our present invention, like the *Kanagu et al.* invention, utilizes a global heating and specifically directs, for example, air at an elevated sealing softening temperature to the sides of our panel sandwich.

Finally, the *Cho et al.* reference further suggests removing trapped undesirable gases after sealing in a vacuum chamber, as set forth in Column 12, Lines 43-55.

The Office Action contended that it was possible to find a teaching or motivation not only in the cited references but also in knowledge generally available to one of ordinary skill in the art under 35 U.S.C. § 103. However, this form of rejection still requires a specific citing of such a teaching for combining the references since clearly the references themselves do not suggest the features set forth in the claims. A contention that a "teaching" for making such a combination could simply be found in that one of "ordinary skill in the art at the time the invention was made would combine two diverse references in order to <u>improve efficiency and</u>

desired characteristics of the display panel" is not supported by any legal citations. Unless the references recognize the problem sought to be addressed by the present invention and suggest a solution, this alleged justification of the rejection is basically a boot-strap argument and not appropriate since it does not permit the applicant to have an opportunity to address and argue any specific teaching relied upon to provide the motivation for such an asserted combination of references.

Finally, the *Aoki et al.* (U.S. Patent No. 5,951,350) certainly does not address any of the deficiencies in the *Kanagu et al.*, *Cho et al.*, or the *Inoue et al.* references, but rather simply was cited for a blue phosphorous layer. Additionally, simply adding a blue phosphorous layer into either the structure of the *Cho et al.*, *Kanagu et al.*, or *Inoue et al.* reference would not provide the increased luminescence intensity and prolonged life of the display panel as set forth in our claims.

In summation, our sealing step not only permits a decontamination to protect and prolong the life of blue phosphorous cells, but also at the same time seals the sealant layer and removes the gaps in one process of global heating.

Applicant has attempted to address the issues in accordance with the dictates of 37 CFR Section 1.116 and believes that a fair and objective evaluation of the combination of references would find that the present invention should be allowable over the claims set forth herein.

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If the Examiner believes that a telephone interview will help further the prosecution of this case, he is respectfully requested to contact the undersigned attorney at the listed telephone number.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on December 1, 2003.

By: James Lee

Signature

Dated: December 1, 2003

Very truly yours,

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